THE ACTIVATION STRATEGY OF ENERGY SERVICE COMPANIES (ESCOs) UNDER DEREGULATION IN KOREA

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ABSTRACT

In Korea, the term ESCO (Energy Service Company) is known as any company that installs new equipment resulting in saving energy cost. ESCOs were formed based on the 1991 'Energy Utilization Rationalization Act' in Korea. It has promoted industrial energy saving and brought up the ESCO as an energy saving industry. ESCOs have increased from 3 in 1992 to 33 in 1999 in Korea.

Notwithstanding of the huge increase, ESCOs have faced the major problems such as the lack of awareness, the lack of experience and the lack of various saving investment services. The role and function of ESCOs are also expected to change with the restructuring of electricity industry in Korea. Therefore, it is very urgent to form energy saving markets through activation of ESCOs, and develop its policy and strategy toward activation of ESCOs.

This paper reviews the status of ESCOs in marketing energy efficiency and the major issues and problems of ESCOs system in Korea. Furthermore, this paper describes activation policy of energy markets and strategies for the energy efficiency under the restructuring of electricity industry in Korea

Introduction

Korea has formulated the 'Energy Utilization Rationalization Act' and a related enactment since 1991 in order to establish policies that address the energy conservation market. As part of these important policies, the government established an Energy Service Company (ESCO) system and 31 ESCOs are currently operating in Korea under the system.

The interest in the ESCO system is rising, but objective studies on energy conservation programs and diverse researches on the energy conservation market are still lacking. However, considering the effects after restructuring of the electricity industry, it is time for the future direction of energy conservation programs to be rediscovered.

This paper analyzes the on-going restructuring in electricity industry in Korea and its effect on the energy conservation market and long-term development and direction of energy conservation.

Current Situation of ESCOs in Korea

Energy Consumption Structure

Korea has a high growth rate in energy consumption due to rapid economic growth and heavy consumption-oriented industry structure. The energy import dependence gradually aggravated from 73.5% in 1980 to 97.1% in 1998. Because of this heavy energy import dependence, energy import accounts for 15~18% of annual total imports. In 1997, the energy import costs were 27 billion dollar and increased four times greater than costs from 10 years ago. The energy consumption and growth rates are shown in Table 1.

Table 1. Energy Consumption and GDP Growth Rate Trend

	1990	1991	1992	1993	1994	1995	1996	1997
Growth Rate in Energy Consumption	14.1	11.2	12.0	9.4	8.2	9.6	9.8	5.9
Growth Rate of GDP	9.5	9.1	5.1	5.8	8.6	8.9	7.1	5.5

The elasticity of energy consumption[1] is sharply increased due to relative stability of energy prices and expansion of energy-using equipment & appliances such as automobiles and air conditioners. The energy balance in Korea is 0.43 TOE[2] per $1000 and is two or three times greater than those in other advanced countries. Thus, it is necessary for Korea to make efforts toward developing energy conservation.

Energy Conservation Program's Goal

The government formulated a 10-year national energy-conservation technology plan in 1996 and is implementing the plan for the exploitation of available natural resources and energy consumption reduction. This year, it is formulating a 3-year alternative energy dissemination plan and is scheduled to evaluate and upgrade the 10-year plan. Under the 10-year plan, the government's goal is to reduce energy consumption by 3.6 million TOE, 2.0% of total energy consumption by 2002 and 20 million Toe, 10.0% of total energy consumption by 2006.

Current Situation in Energy Conservation Program

Under the above background, the government formulated several policies and regulations for the energy conservation and effective utilization of energy since 1970s and focused on restriction of energy consumption through regulation and order. Korea has established the related enactment regarding the ESCO system since 1991. The scope defined by the law covers the implementation of the program related to energy conservation:

- Management and service program for energy conservation in energy-use facilities
- Program for investment towards energy conservation-oriented facility
- Program for energy audit and for other related energy conservation management

In 1992, 3 private ESCOs were registered and participated in the energy conservation program. In 1999, 31 ESCOs are currently operating in 399 energy conservation programs funded at approximately 100 million dollars. Major energy conservation efforts in these programs focused on electronic ballast, co-generation plant, and steam-generating equipment.

[1] Energy elasticity reflects the change in energy consumption for a unit change in the GDP.

[2] TOE stands for Tons of Oil Equivalent. A conventional unit that can be used to describe the size of any energy source by comparing its energy potential with that of crude oil.

Table 2. Trend of ESCOs

Classification	1992	1993	1994	1995	1996	1997	1998	'99.1	Total
Number of ESCOs	3	1	2	-	1	9	13	2	31

Table 3. Trend of Assistance for ESCOs

Classification	'93 ~'97	'98	'99.10	Total
Loan Assistance (100 million won[3])	184	334	557	1,037
Loan Assistance (cases)	58	139	202	399

Table 4. Achievement by field among ESCO Projects ('93 ~'99 October)

Field	Number of Cases	Total Investment (100 million won)
● High-Efficiency Lighting	293	290
● Cogeneration System	8	216
● Process	18	182
● Economizer System	26	156
● Cooling & Heating	23	124
● Motors	19	54
● Boilers Replacement	8	6
● Etc.	4	9
Total	399	1,037

Assistance to Energy Conservation Program

For the activation of ESCOs, the government in Korea is assisting ESCOs in areas of finance, tax, public relation (P.R.) and the revision of rules:

♦ Assistance in areas of finance and tax
- Assistance of Energy Use Rationalization Fund for ESCO Program: Within $5 billion
- Formulating Sales Bond Factoring Policy for Debt Diminishment of ESCOs
- Assistance of operating cost for small-sized ESCOs
- Tax reduction to facility investors through ESCOs

♦ Assistance in area of P.R.
- Annual Opening of Energy Saving Mart

♦ Revision of related rules
- Development of Performance Standard Contracting Model

[3] won is a monetary unit of Korea. U.S. 1 dollar equals 1,100 won as of May 2000.

- Setup an organization for solving conflict
- Formulation of Contract Basis and Audit related Codes

Achievement and Situation in Energy Conservation Program

Achievement of Energy Conservation Technology Development

Since 1992, 186.6 billion won was invested towards 526 programs of Energy Conservation Technology Development. The government's financial assistance was 124.6 billion won and amounted to approximately two-thirds of total investment. The major energy conservation achievements are for electronic ballast and compact fluorescent lighting measures. These measures are government warranty items. Pre-purchase of the measures by public institutions receives the government warranty. The number of LNG vehicles is increasing due to policy assistance such as price compensation by the Ministry of Environment (MOE). The achievement of Energy Conservation Technology Development is the following:

Kind of Technology	Energy Savings by Technology	Dissemination
26mm Fluorescent Lamps	20% (Replacement of 32mm Fluorescent Lamps)	6.6 million
Electronic Ballasts	37% (Replacement of Magnetic Ballasts)	3.7 million
Compact Fluorescent Lighting	75% (Replacement of Incandescents)	3 million
High-Efficiency Motors	5%	40000/year
High-Frequency Induction Furnaces	40% (Replacement of Vacuum Tube Type)	20
Ultrasonic Generators	65%	30
High-Efficiency Boilers	10%	10
Energy-Efficient Refrigerator	10%	2 million
Window Insulation	70% (Replacement of PVC doublepane)	34000 set

Effects and Evaluation of Energy Conservation

By commercial use of 43 out of 143 technologies, it is expected that Korea will save 1.2 million TOE in energy conservation and 560 billion won due to energy conservation effect and import-substitution effect. Upon the condition that Energy Conservation Technology Development program is well executed, it is expected that Korea will save 2.8 billion dollar due to energy import decrease and obtain the improvement of price competitiveness and import-substitution effect. In environmental aspect, it is expected that the emission of CO_2 will be decreased by 1.1 million ton, SOx by 300 thousand ton and NOx by 90 thousand ton annually. In technological, social aspects, it is expected that scientific technological standard will be improved and the infrastructure of R&D will be constructed and due to the dissemination of technology toward related industry, the development of research areas will be continued.

Year	Energy Conservation (1000 TOE)	Energy Conservation (100 million won)	Import-Substitution Effect (100 million won)	Total (100 million won)
'99	451 TOE	1,091	753	1,844
'96 ~ '99	1,198 TOE	2,885	2,698	5,583

However, the above results are still below the original intended goal. In 1999, energy savings amounted to 0.3% of total energy consumption. When this trend continues, it will be difficult that energy conservation result amounts to 10% of total energy consumption by 2006. These poor results are due to several factors. It is believed that the decrease in investment, the imperfection of energy conservation infrastructure and the lack of conservation incentive resulting from the relative stability of energy price are key factors explaining these poor results.

Current Situation of Energy Conservation Program

The energy conservation program in Korea is in its initial stage, and the interest in energy conservation program is rising sharply. The trend shows the change in consumer's perception on energy conservation program and in government's support for these programs. But, for the desirable energy conservation market and related industry's development, the construction of infrastructure for market formation should be made. And, the study on all possible effects after restructuring of electricity industry should be followed.

♦ Construction of infrastructure for energy conservation market
- Deficiency in index of base demand per end-use in energy consumption and index of forecasting in base demand per end-use in energy consumption
- Nonexistence of index in energy conservation analysis such as energy saving potential
- Undeveloped cost-effective energy conservation program
- Lack of energy conservation researches and nonexistence of professional research institute
- Undeveloped systematic energy conservation program's implementation such as market rule and transaction rule

♦ Effects after restructuring in electricity industry
- Change in supporting of main body and supporting methods
  : Privatization of monopolistic public enterprises in energy field such as Korea Electric Power Company (KEPCO), and Korea Gas Corporation (KOGAS)
- Change in sources and scale of financial support
- New market environment formation due to participation of private electric power companies
- Necessity for standard of commercial program and public program

Restructuring in Electricity Industry and Direction for Energy Conservation Program

Restructuring in Electricity Industry

Restructuring in electric industry is under way in Korea. It is scheduled that the split-up of the power distribution sector into several power distribution companies and

introduction of competition in the wholesale and retail prices will take place by 2009.

It is expected that restructuring in electric industry will have great impact on domestic energy conservation program because electric industry holds a large portion in energy conservation program. In other words, a large portion of current energy conservation programs receives rebate or technological support from electric companies' fund. A monopolistic public enterprise under the present electric industry is carrying out the public function that the government is supposed to do.

Along with restructuring in electric industry, when the split-up and sale of the KEPCO into several private companies happens, KEPCO can no longer carry out the public function. Hence, the government should look at other alternatives in carrying out energy conservation program.

Table 5. Restructuring schedule in Korea

Phase	Year	Content
Phase I	Before 2000	- Preparation of provisions for competition - Separation of generation sector
Phase II	2000 ~ 2002	- Implementation of competition in generation sector - Separation and privatization of distribution sector - Preparation for a bidding market
Phase III	2000 ~ 2009	- Implementation of wholesale competition - Allowance of direct deals for large customer
Phase IV	After 2009	- Implementation of retail competition

Direction of Energy Conservation Program

The Ministry of Commerce, Industry and Energy (MOCIE) is focusing on development of new and renewable sources of energy (NRSE) and demand-side management (DSM)-oriented energy conservation for the preparation of future environmental issues and the maximization of natural resources' exploitation. Particularly, along with the soar of present world oil price, energy conservation becomes a national issue. Thus, the government is going to provide diverse alternatives and plans for the issue.

The following basic initiatives and standards must be applied to implement energy conservation program and, under this basis, trial and errors in domestic policies and foreign case studies should be taken into consideration. First of all, there are two different programs. One is marketable commercial program. The other is a program needs the government support due to failure of the market. The government should provide alternatives by considering the programs' own characteristics. Secondly, by differentiating programs which are easy to disseminate at short period through improvements in policies from potential programs that are carried out at mid-term or long-term periods such as market environment, technology environment and commercialization. Finally, we should take into account non-economic aspects such as environment, energy safety, fostering related industry, and technology development along with economic aspects. Most of all, the national energy policy should be taken into account.

In Korea, state-oriented economy is transforming into a market-oriented economy in accordance with worldwide trends such as globalization, restructuring, deregulation, and

minimization of government involvement. The government is devising a policy in areas where social benefit takes a high portion such as energy conservation for supplementing market function. The financial support KEPCO paid until now is switching to customer surcharge which will be used for energy conservation, alternative energy development, and technology development. Cost-effective programs will depend on the market conditions.

In energy area, when the market economy is introduced, current energy prices, which do not reflect real market value, will be approaching market prices. When this happens, it is possible that the demand for energy conservation will increase. Hence, the government is trying to induce commercially viable energy conservation through assistance to energy prices or minimization of cross-subsidy.

Activation Strategy in Energy Conservation Program

Energy Conservation Plan and Setting-up Goal

In order to implement energy conservation program effectively, it is necessary that we set energy conservation goals and establish energy conservation plans which will back up the goals. The government is already implementing energy-related goals and plans, and in most cases they are not based on analysis but policy-decision.

Table 6. Energy Conservation Goals by Field

Field	Forecast for electricity demand in 2006 (BAU)			Energy Conservation Goal (AP)	
	GWH	Million TOE	%	GWH	Million TOE
Lighting	56,163	14.04	18.0	5,897	1.47
Motors	159,070	39.77	51.0	7,238	1.81
Application of Motors	8,488	2.12	2.7	509	0.13
Small-Scale Cogeneration	183	0.05	0.1	1,638	0.41
Converter/Inverter	14,651	3.66	4.7	564	0.14
Furnace	50,349	12.59	16.2	2,517	0.63
Energy Storage	-	-	-	137	0.03
EMS	312	0.08	0.1	588	0.15
Cooling & Refrigeration	14,958	3.74	4.8	598	0.15
Appliance	1,870	0.47	0.6	33	0.01
Superconductor	-	-	-	36	0.01
Electric Vehicle	3,840	0.96	1.2	54	0.01
Etc.	1,745	0.44	0.6	79	0.02
Total	311,629	77.91	100.0	19,887	4.97

Table 7. Electricity Conservation Potential by End-Use (Unit : GWh)

	End-use	1999	2000	2005	2010
Residential	Cooling	272	397	1057	1396
	Refrigeration	554	776	2117	2764
	Lighting	2237	2513	4158	5254
	Etc.	161	194	386	495
Commercial	Lighting	2627	3270	6750	9175
	Motors	879	1298	3536	4908
	Cooling	514	770	2145	3292

Table 8. Key Energy Project by Field

	Heat Generating System	Conversion/Transportation	Heat Application
Heat	Industrial Furnace	Group Energy, Wasting Energy	Dryer
	Cogeneration System	Energy Conversion & Storage	HVAC
Electricity	-	-	Lighting/Motors

Table 9. Government-leading Energy Conservation Program

Field	Program
Industry	Process control & automation, Combustion, Heat change etc.
Metal	Functional Energy materials etc.
Building	Building automation system, Building management system etc.
Transportation	High-efficiency vehicle
Electricity	Appliances, Cooling & Refrigeration, EMS, Energy Storage, Furnace, Superconductor, DSM etc.

Construction of Infrastructure and Diversity of Programs

Providing various, reliable, and related information on the energy conservation market is the key for activation of programs. Especially, it varies from a simple program at the initial stage to high value-added programs including system engineering.

♦ Provision of Energy Conservation Index and Information
- Survey and forecasting on energy consumption data
- Evaluation of energy conservation potential
- Construction of database for energy demand-side management
  : demand, cost, energy conservation technology, energy-use facilities

♦ Diversity of Programs
- Focus on equipment and facility → switch to energy consulting, engineering
- Creation of new energy conservation product and program
- Linkage with success-optioned technology development

♦ Building System for Evaluating Programs
- Establishing annual mile stone and goal on technology development
- Pre and post evaluating energy conservation effect due to technology development
- Post monitoring on technology dissemination

Implementing Energy Conservation Programs in Public Area

For public institutions to take the lead in energy conservation and in improvements of end-use efficiency, it requires us to save the national budget and put the focus on energy conservation in order to contribute to the formation of the energy conservation market. Public institutions can do this by:

♦ Increasing Participation by Public Sector
- Providing incentive in energy conservation in public sector : compensation for saving budget
- Diffusing the energy conservation culture throughout education programs, P.R.

♦ Building Sector
- Placing public institutions under the obligation to use ESCO program
- Placing new public building under the obligation to use high-efficiency warranty products
- Placing every building under the obligation to take energy management audit

♦ Transportation Sector
- Providing a policy which favors to promote purchasing of light automobile
  : waiving parking fee
- Efficient utilization of automobiles

Restructuring in Energy Industry and Optimization of Price Control

It is urgent to establish a market structure in accordance with overall restructuring in energy industry and to correct present energy market distorted by over-regulation by government and to devise rational standards for regulation.

♦ To change to competition-promoted structure in energy industry
- To transform market system in all competition-possible field
- Deregulation of new entry in natural monopoly industry such as electricity, natural gas, collective energy

♦ To arrange ways for energy price regulation corresponding market structure
- Competitive market : to devise policies promoting fair competition in market
- Monopolistic market : to devise policies inducing incentives like cap-pricing

♦ To check the functioning of market and establish professional institution
- To reduce and transform the government's responsibility in market management
- To establish professional institution for neutral market management
- To devise new regulation standards for market management

♦ To implement policies related to energy
- To integrate taxes related to energy and restructure
- To improve equity between energy sources
- To reflect incentives for energy conservation on evaluating public institutions
- To devise standards for demand and supply in energy conservation

Expanding Demand-Side Management Investment Program

In social aspect, it is necessary to develop cost-effective demand-side management (DSM) programs, and increase in investment for these programs and devise the standards for implementing these programs. Particularly, it is important to develop an advanced system which can monitor the on-going performance of DSM.

♦ To develop DSM programs and disseminate them
- To select the energy enterprise in public programs
- To support investment in DSM
- To evaluate and monitor performance of DSM

♦ To provide consumer-oriented rebates
- To classify efficiency rating of the energy equipment
- To provide rebates on high efficiency energy equipment
- To switch focus from supplier-oriented to consumer-oriented programs

♦ To strengthen DSM of building energy use
- To audit high energy consuming buildings
- To introduce a building energy warranty policy
- To construct basis for green building information

Development of Energy Conservation Technology

The basic strategy is to increase energy-conservation by supporting the development of large-scale technology programs for the initial three years, achieving energy-conservation goals by commercializing the energy-conservation technology and promoting the dissemination of the energy-conservation technology. For next three years selection and support of high-priority technology among future-oriented energy-conservation technology will take into account the trends of the advanced countries.

By considering technological competitiveness with advanced countries, commercialization of energy-conservation technology and dissemination effect of energy-conservation technology, Korea is going to select and support large-scale core technology programs to induce the maximization of Research and Development (R&D) performance and Technology-Push.

New approaches for energy-conservation technology R&D are necessary for the addressing the climate change of the earth due to global warming gas emissions. That is, energy-conservation technology should be treated as an available core tool that can help achieve the goal of cutting CO_2 emission. Considering that design of the strategy for this is high-priority, energy-conservation technology is divided into short-term commercialization technology and mid-long term new technology. It is desirable that development of short-term commercialization technology should be made by bottom-up approach and development of mid-long term new technology should be made by top-down approach.

Table 10. Action Plan for Energy Conservation Technology Program

Period	'2000 ~ '2002	'2003 ~ '2006
Action Plan	- Achievement of energy conservation potential by development of large-scale complex technology among key core technology - Dissemination of short-term commercialization technology	- Achievement of energy conservation goal by development and dissemination of large-scale complex technology - Development of future-oriented next-generation energy conservation technology

Table 11. Energy Conservation Technology Program

Project	Field	Program
Energy Technology Field (Electricity)	New Lighting	New Lighting, Lighting Control & System
	Motors	Induction Motors, Special Motors, etc.
	Appliances	Cooling & Refrigeration, etc.
	Industrial Application	High-efficiency Transformer, Inverter, Industrial Furnace, Battery, etc.
	Power System	DLC, Energy Storage, EMS, Superconductor
	Policy and System	DSM Estimation, Demand Forecasting, etc.

Table 12. Energy Conservation Technology Program (million won)

Year / Field	2000	2001	2002	2003	2004	2005	2006	Total
New Lighting	3,660	3,770	3,260	3,750	2,820	2,760	3,050	23,070
Motors	6,800	7,460	9,800	10,350	8,550	9,880	10,250	63,090
Appliances	3,180	3,410	3,800	2,050	2,580	2,610	2,820	20,450
Industrial Application	6,490	8,560	12,110	14,820	16,120	16,650	16,700	90,980
Power System	4,100	7,860	10,980	14,820	16,690	14,770	9,900	79,120
Policy and System	530	500	720	860	990	830	1,000	5,430
Total	24,760	31,560	40,670	46,180	47,500	47,500	43,720	282,140

Conclusion

For the dissemination of ESCO programs, the following are necessary. First, Korea needs to redesign the plan in order to expand investment in the public sector and to foster the scale and competitiveness of ESCOs. Second, based on strengthening marketability and technological advantages, ESCOs need to develop various products and disseminate them in the private sector. Third, it is necessary that ESCOs develop easy market-accessible programs and the public sector plays a leading role for the activation in the initial-stages of market development. Finally, it is necessary to build bases such as collecting all technological and demand and supply information, formulating policies, changing perspectives on the energy conservation market and designing rules which allow consumers easily to gain access to the energy conservation market.

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